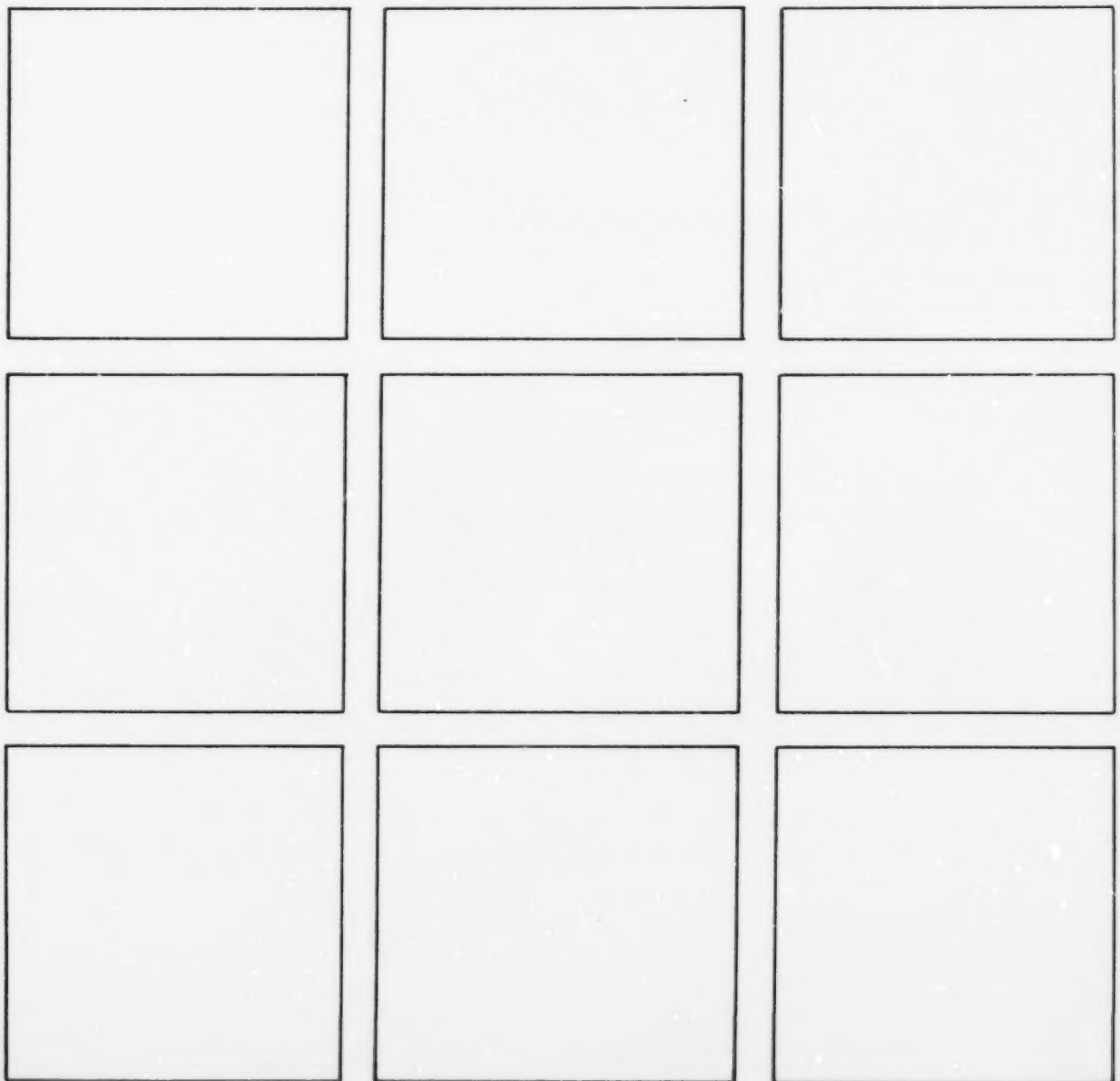
OWMC

Ontario
Waste Management
Corporation
System
Development
Project

The Proctor & Redfern Group

Primary Information

Engineering Infrastructure



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Dear Sir

Engineering Infrastructure -
Primary Information Study

We are pleased to present the final report of the Engineering Infrastructure - Primary Information.

This report identifies certain siting constraints related to infrastructure and draws some preliminary or general conclusions.

Yours very truly

Proctor & Redfern Limited

W. D. Goodings
Vice-President

WDG:sm
Encl.

ENGINEERING INFRASTRUCTURE

ONTARIO WASTE MANAGEMENT CORPORATION

PRIMARY INFORMATION

FACILITIES DEVELOPMENT PROCESS

August, 1982

Proctor & Redfern Limited
75 Eglinton Avenue East
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ONTARIO WASTE MANAGEMENT CORPORATION

BACKGROUND INFORMATION

The Ontario Waste Management Corporation (OWMC) is a provincial crown agency created in 1981 by the Ontario government to establish a liquid industrial waste and hazardous waste management system for the province. One of the first tasks of the Corporation was to examine the possibility of constructing a treatment and disposal facility at South Cayuga in the Regional Municipality of Haldimand-Norfolk. Preliminary hydrogeological studies of the site revealed that it had several short-comings and the Board of Directors of OWMC voted unanimously to reject the site in November 1981.

Following the rejection of the South Cayuga site, OWMC developed a corporate plan which incorporated:

- The need to design and build a waste treatment and disposal system to manage safely liquid industrial waste and hazardous waste not presently receiving adequate treatment and disposal in Ontario.

- The need to assist Ontario industries in identifying additional, practical ways to reduce and/or recycle liquid industrial waste and hazardous waste.

- The need to consult with the public on the nature and scope of the industrial waste problem and how it can be remedied.

Before a treatment and disposal facility is built, detailed proposals must be presented to an independent Hearing Panel appointed by the Ontario Government, and public hearings will be held.

OWMC is not a regulatory agency, nor is it responsible for treating and disposing of domestic or radioactive wastes.

TABLE OF CONTENTS

		Page
1.0	**INTRODUCTION**	1
2.0	**PURPOSE**	2
3.0	**SUMMARY**	3
4.0	**REPORT**	4
	4.1 Unit Processes	4
	4.2 Facility Requirements	5
	4.3 Effluents/Sidestreams/Residuals	7
	4.4 Constraints	8
	4.5 Conclusions	11
5.0	**APPENDICES**	14

1.0 INTRODUCTION

Similar to a sophisticated, large-scale industrial complex, OWMC facilities for handling liquid industrial waste and hazardous wastes will require a full range of services, or engineering infrastructure, including electrical power, fuel, water, sanitary and storm sewerage, transportation and other utilities.

While the size and complexity of the facilities required to provide these services cannot be defined at this preliminary stage, it is possible to draw some conclusions based on the knowledge of the types of materials to be handled, the basic unit processes already identified, and historical information from similar waste facilities constructed and operating in North America and Europe.

2.0 PURPOSE

This preliminary information report provides a general description of the waste to be handled and the alternative treatment technologies as well as identifying the Southern Ontario engineering infrastructure requirements and their availability.

3.0 SUMMARY

The engineering infrastructure requirements for waste treatment/disposal facilities can readily be provided for electrical power, transportation, fuel, water, and storm sewerage. However, the requirement for the assimilation of aqueous effluents and gaseous emissions from the treatment process will create certain constraints on site selection.

It is anticipated that, notwithstanding the advanced level of treatment that will be provided for liquid wastes and sidestreams, dilution and further treatment in a municipal wastewater treatment plant would be a benefit, and hence, not only will backup treatment be provided, but facility location in close proximity to a large receiving body of water will not be essential.

Alternatively, direct discharge after treatment, to a surface body of water is a possibility that will be evaluated.

The effect of stack emissions on existing and future adjacent land-use is a major consideration in siting a waste treatment facility that includes incineration as a treatment option. The impingement concentrations must be carefully evaluated taking into consideration stack height, land use and separation distance prior to determining the suitability of potential sites.

4.0 REPORT

4.1 Unit Processes

Industrial waste is generated in three forms:

- liquid
- sludge
- solid

The liquid organic portion, representing approximately 30 percent of total liquids, and also a good portion of the organic sludge and solids, can be safely treated by incineration. Certain liquid organic waste, are also amenable to biological treatment.

The liquid inorganics can be safely treated by a combination of physical and chemical processes.

Other waste can be safely placed in secure landfills.

Deep well injection and underground storage in geologic formations may also be possible for certain waste.

Storage of some waste may also be required.

Some waste will be reduced or eliminated at source by resource recovery processes.

Thus the OWMC system may contain all or some of the following unit processes or components:

- Resource Recovery
- Collection and Bulking
- Physical/Chemical

- Incineration
- Retrievable Storage (both above and underground)
- Solidification
- Deep Well Injection
- Secure Landfilling

4.2 Facility Requirements

The above noted possible components of the OWMC system require the following engineering infrastructure, some of which may prove critical in siting facilities:

- Electrical Power
- Fuel
- Water
- Sanitary Sewerage
- Storm Sewerage
- Transportation
- Miscellaneous Utility

Electrical Power

Electrical power is required for lighting and electromotive force for mechanical equipment. We have examined the principal power facilities as well as municipal systems supplied by Ontario Hydro. There is extensive service provided throughout southern Ontario. The electrical requirements from the Sakab Hazardous Waste Facility in Sweden were in the range of 1,000 - 3,000 kw. Such a facility in Ontario would require only a transformer station plus line connections.

Thus electrical power is considered a relatively minor factor in siting.

Fuel

Fuel is required for heating and as an energy source for possible thermal processes. In a fashion similar to electrical power, fuel in the form of either natural gas or oil is available in Southern Ontario.

Again, fuel is a relatively minor factor in siting.

Water

Potable water is necessary for human consumption and some process utilization. Non-potable water is required for fire-fighting purposes. Relative supply rates at the Sakab Facility in Sweden were 10 L/s potable, 300 L/s fire-fighting. These quantities would in all probability be available at most locations in southern Ontario.

The availability of water is probably a minor factor in siting.

Sanitary Sewerage

Sewage treatment is required for sanitary sewage disposal.

The typical saline characteristics of the aqueous effluents from physical/chemical facilities and the flue gas scrubber equipment normally associated with incinerators usually require dilution since further treatment by such methods as reverse osmosis is usually difficult and extremely costly.

An existing sewage collection and treatment system may prove to provide the best available facility to safely serve as a receiver for these aqueous effluents. Such a system would also provide further treatment and a final safety factor. Hence, the availability of such a sewerage system may become a critical factor in siting.

The ultimate waste water receiving stream, as discussed later, is an integral part of the same siting factor.

Storm Sewerage

Storm sewerage is necessary for the collection and discharge of storm water emanating from the site. On typical sites, stormwater is retained, analysed and if found polluted, treated.

This aspect should not prove to be an important factor in siting.

Transportation

Transportation systems in southern Ontario reach virtually all parts. The Provincial highway system serves and embraces all cities and towns where wastes are being produced.

Local road systems have less consistency in terms of continuity, geometrics and structural standards.

Where possible, use of the Provincial highway system should have preference when establishing haul routes to the proposed OWMC facilities. Haul cost reductions and risk minimization will likely be the result.

A Transportation document has been prepared to separately address these matters in greater detail.

Miscellanous Utilities

Those utilities such as telephone and other communication systems are available throughout southern Ontario in all but the remotest areas and hence this aspect is a minor factor in siting.

4.3 Effluents/Sidestreams/Residuals

The various components of the subject waste management system in the process of treating waste, produce the following effluent and sidestreams:

- aqueous effluents (including leachate)
- sludges
- stack emissions
- fly ash
- slag

Sample Characteristics

In order to identify more precisely the nature of some effluents and emissions from the components of a waste management system, we have included in this report (located in Appendix 1) tables which list the characteristics of some effluents and sidestreams from some of the actual operating plants that were visited in both Europe and the United States, and also projected effluents or licensed effluents from other facilities.

The titles of these tables are listed below:

Table 1 Physical Chemical Facilities Effluent Characteristics

Table 2 Flue Gas Scrubber Water Characteristics Ebenhausen, GSB Bavaria, Germany

Table 3 Flue Gas Characteristics (After Treatment)

Table 4 Leachate Characteristics, Hazardous Waste Landfill Gallenbach, GSB, Bavaria, Germany

4.4 Constraints

A study of the physical, chemical and biological characteristics of the probable sidestreams, effluents and residuals indicate that few would be likely to present serious constraints to siting a special wastes facility. Slag can be readily placed in landfill or even fill areas. Fly ash and sludges can be treated and removed to a secure landfill. Aqueous effluents and stack emissions may represent siting constraints.

Stack Emissions

Stack emissions (flue gas) from a properly designed incinerator may have those characteristics cited in Table 3.

As Ontario's regulations are based upon impingement criteria, concentrations of various parameters must be further investigated in light of stack height, topography, surrounding development and hence impingement.

Thus, the stack emissions and their corresponding effects on the surrounding areas are a critical factor in siting of a thermal destruction unit.

Aqueous Effluents

A study of the characteristics of the aqueous effluents in Tables 1 and 2 suggests that the principal concern would be the effect of discharging these highly saline effluents on a receiving body of water should no further treatment be found to be technically or economically feasible.

In Ontario, effluent requirements are established on a case-by-case basis for surface waters. "In establishing effluent requirements, the characteristics of the receiving water body will be considered."*

The range of concentrations of various contaminants can be properly evaluated only in concert with the characteristics of the receiver. Once potential components of sites are clearly identified and the characteristics of the effluent identified, then the effects of discharges upon the quality of the candidate receiving body of water will be assessed.

Existing Intakes and Outfalls

Appendix 2 contains an inventory of outfalls in the Great Lakes and major river basins of southern Ontario. The outfalls are associated with municipal waste water treatment plants. Industrial outfalls are not identified at this time.

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* Water Management - Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment (Nov. 1978)

We have included only outfalls of capacity 5 ML/d and above which may require further study. Shore based outfalls and channels have also been excluded.

As a next step in the study process, information on existing outfalls that appear to be of significant interest will be further refined to include the quality of the receiving body of water, and its dilution capability, proximity to all water intakes, as well as other critical environmental factors.

MOE Effluent Guidelines

The major contaminants of the liquid effluent streams are dissolved solids (chlorides, sulphates). The Ontario Ministry of the Environment, Water Management "Blue Book" indicates no specific discharge limitation but rather indicates that the discharge should not increase the ambient concentration of the receiving body of water by greater than one third of the background concentration.

This may dictate that the site of these facilities should be in reasonable proximity to a large receiving body of water or alternately require access to a sewerage system which discharges its treated effluent to a large receiving body of water. In either case, there would have to be constructed, or have to exist, a well designed outfall piping system and diffuser.

Discharge to a sewage collection system offers the following benefits:

1. Dilution of saline streams within the collection system as well as within the sewage treatment works (diffuser or outfall).

2. Biological treatment of potential trace carryover biodegradable organics within the effluent.

3. Potential as backup for treatment of wastes in the unlikely event of an operational minor upset at a proposed OWMC facility.

In the discussion of sanitary sewerage, we alluded to the possibility that there could be further treatment of saline streams to allow direct discharge to a surface body of water. In this connection, we believe that "reverse osmosis" technology may have merit and application and hence we will examine this possibility further. However, in doing so, we must address factors such as extensive pretreatment requirements, operating reliability, maintenance requirements, and the need to dispose of significant concentrations of salts in the residual streams emanating from such a facility.

Landfill Leachate

The leachate originating from a secure landfill, sample characteristics of which are cited in Table 4, clearly suggest that such leachate must be treated prior to discharging to the environment. The characteristics of the leachate indicate that this material is similar to strong toxic industrial waste and must be treated at a competent treatment facility. It may be necessary to provide for on-site treatment or transport leachate to the OWMC treatment facility.

The location of engineering infrastructure is not a major factor when siting a secure landfill.

4.5 Conclusions

Until the selection of components is made and a reasonably accurate sizing of facilities proposed, a more detailed screening of factors cannot be undertaken.

The following is a list of unit processes, their effluent/sidestreams and the effluent/sidestream treatment and/or disposal:

Biological Treatment

- Liquid effluent considered satisfactory for direct discharge
- Sludge requires disposal

Physical-Chemical

- Liquid effluent has saline characteristics with a high concentration of dissolved solids, has some organic portion, and requires further treatment prior to discharge

- Sludge requires further treatment

Incineration

- Flue gas scrubber water requires further treatment prior to discharge

- Fly ash requires secure landfilling

- Slag requires disposal

- Stack emission, after cleaning, requires dispersion

All Processes

- Stormwater may require treatment prior to discharge

Secure Landfill

- Leachate requires further treatment

In Conclusion:

1. Provision of services such as electricity, fuel and water supply, storm sewerage, transportation and other utilities, will not pose significant problems for waste facilities in most areas of southern Ontario.

2. The significant infrastructure requirements that will place constraints on site selection are as follows:

- Disposal system for aqueous effluents
- Dispersion area for stack emissions.

APPENDIX 1

SAMPLE CHARACTERISTICS OF EFFLUENT/SIDESTREAMS

LEGEND FOR TABLE 1 - SAMPLE PHYSICAL CHEMICAL EFFLUENTS

Facility A: Permitted Discharge Limits - Kommunekemi, Denmark

Facility B: Proposed Discharge Quality, York Penn., Liqwacon Corp.

Facility C: Proposed Discharge Quality, Canton, Ohio, Liqwacon Corp.

Facility D: Excerpt from Discharge Permit - Expiry May 1, 1985, S.C.A. Chemical Services, Model City, N.Y.

Facility E: Re-Chem International, Southampton, England - 1.

Facility F: G.S.B. Ebenhausen, Bavaria, Germany

Note 1: In comparing applicability to Ontario, it must be recognized that it may not be practical to treat all effluents to meet Ministry of the Environment Objectives. "Some volume of water must be provided for dilution or modification of waste effluent before objectives can be met." (Water Management, Nov. 1978, M.O.E.).

Note 2: It is stressed that these are sample and not typical characteristics. The word "typical" truly does not apply as these streams are totally waste specific, i.e. related to what the waste facility is receiving and hence is treating.

The tables are only of use in that they identify the potential nature of the probem.

Note 3: The columns under Facilities A - D represent consent or licensed limits.

Facility A discharges to an ocean.

Facilities B and C discharge to a sanitary sewerage system leading to a large treatment plant.

Facility D discharges to the Niagara River.

The columns under E and F represent actual analyses of effluent.

TABLE 1 - SAMPLE CHARACTERISTICS

PHYSICAL CHEMICAL FACILITY EFFLUENT

PARAMETER	FACILITY A	B	C	D	E	F
pH	6.5 - 8.5	6.5 - 9.5	6.5 - 9.5	6.5 - 8.5	9.5	7.8
Cr Total	0.2*	0.2	2.0	1.0		
Hex Cr		0.05	0.10	0.1		0.1
Zn		0.25	1.5	1.0		0.8
P		0.2	0.3	0.2	0.2	1.0
Cu		1.25	1.8	0.4		1.0
Cd	0.05	0.2	0.4	0.2	0.01	0.2
Ag	0.1			0.1		
Ni		1.0	1.5	2.0		1.0
Total Metals	5.0				1.4	
Fe		0.75	1.5	4.0	0.3	0.6
Al		0.03	0.10	0.5		
Ba		3.0		4.0		
Mn		1.0		2.0		
Sn		2.0		0.01		
Hg	0.5	0.01		.0002		0.1
Oil	10					
Hexane Extract		25	25	15	9.5	1
Phenol	1	1.5	1.5	1.0		0.5
Detergent	5					
T.D.S.		2%				
Cl		2%	2%			25,000
SO_4	5	1%	1%			8,000
Total N		2%	2%	1.5		
Mg		4%	4%			
Ca		1%	1%			
Na		500				
BOD		1,000	1,000	60	30	30
COD		1,400	1,400			
Free Cyanide		0.05	0.05	0.1		
Total S.S.		124	124	60	256	
Temperature			150°C			
Boron			1.0			
Amm. Nitrogen				85	4.3	4
PO_4				5	7.9	1
Chlor. Hydrocarb.					0.005	
TOC						50

TABLE 2

SAMPLE CHARACTERISTICS
FLUE GAS SCRUBBER WATER

PARAMETER	EBENHAUSEN (Germany)	
pH	8.5	
TOC	20	mg/L
SO_4	10,000	"
SO_3	10	"
NO_3	10	"
NO_2	1	"
PO_4	1	"
F	1,500	"
Hg	3.5	"

TABLE 3

THEORETICAL CHARACTERISTICS
FLUE GAS (AFTER CLEANING)

PARAMETER	KOMMUNEKEMI (Denmark)		BIEBENSHEIM* (Germany)	
HCl	600	mg/Nm^3	100	mg/Nm^3
HF	10		5	
SO_2	625		200	
Dust	100		75	
Cd	-(1)		0.14	
Pb	-		0.63	
Cr	-		0.25	
Cu	-		0.14	
Zn	-		0.96	
NO_x	100		-	
Halogenated Hydrocarb.	5		-	
CO	150	mg/l	-	
Total Metals	50	mg/Nm^3	-	

* Biebesheim, Germany, H.I.M. Complex

(1) Not Indicated

TABLE 4*

AVERAGE LEACHATE CHARACTERISTICS
(GALLENBACH)

PARAMETERS	1977	1978	1979	1980
pH	7.0	7.4	7.2	7.4
BOD	2,720**	3,000	4,000	4,650
COD	3,000	3,500	9,000	12,000
TOC	1,600	1,900	4,000	3,400
Cr	0.4	0.7	0.5	0.2
Cu	0.3	0.3	0.4	0.3
Cn	-	-	0.1	0.1
Ni	4.1	5.2	3.6	4.4
Zn	2.3	0.5	0.6	0.4
Cd	0.2	0.1	0.2	0.2
Fe	12	4	4	2.1
Sn	2.3	8	44	34
Pb	0.6	1.0	1.2	1.1
Phenol	2.1	7.3	1.0	10
Chloride	15,000	26,000	37,000	40,000
Sulphate	2,100	3,400	8,300	3,300

* After Franz Defregger, "Collection, Analysis, Treatment of Surface Water and Leachate on the Gallenbach Landfill Site for Hazarous Waste in Bavaria".

** All concentrations in mg/L except pH.

APPENDIX 2

SOUTHERN ONTARIO OUTFALLS

APPENDIX 2

SOUTHERN ONTARIO OUTFALLS

Moe Code	Outfall Description	Capacity (ML/d)	Length From Shore (m)	Diameter (mm)	Water Depth (m) Lake Bottom To Surface	Water Depth (m) Pipe Opening To Surface	Diffuser Information
Lake Ontario Region							
06-03-004	St. Catharines Port Dalhousie STP	32.5	44.5	1,500	4.4	2.7	No No
06-03-007	Grimsby Baker Road STP	7.5	716.3	833	4.8	3.6	
06-03-023	Oakville	24.2	760.0	1,800	8.6	8.2	18 ports
06-03-028	Oakville Southeast STP	9.8	305.0	1,050	4.6	3.8	No
06-03-031	Clarkston STP	56.3	1,521.0	1,050			8 ports
06-03-046	Lakeview STP	171.0	1,415.7	3,048	12.9	9.1	70 ports
06-03-067	Toronto Main STP	772.0	1,000.0	2,740	8.5	9.5	8 ports
06-03-071	Highland Creek	154.0	1,337.6	2,700	7.9	5.2	25 ports
06-03-077	York-Durham	605.6	1,097.4	3,050	8.3	5.4	63 ports
06-03-082	Corbett Creek	12.0	287.5	1,828	7.6	5.4	3 ports
06-03-086	Bowmanville STP	39.7	1,241.0	1,066	4.8	2.7	18 ports
06-03-101	Port Hope STP	6.9	248.3	609			
Hamilton Bay Basin							
09-03-014	Burlington Skyway STP Outfall 2	62.0	282.0	1,800	6.4	5.18	6 ports
09-03-015	Burlington Skyway STP Outfall 1	62.0	278.0	1,200	6.8	5.25	

APPENDIX 2 (CONTINUED)

SOUTHERN ONTARIO OUTFALLS (CONTINUED)

Moe Code	Outfall Description	Capacity (ML/d)	Length From Shore (m)	Diameter (mm)	Water Depth (m) Lake Bottom To Surface	Water Depth (m) Pipe Opening To Surface	Diffuser Information
St. Lawrence Basin							
12-03-002 (12-03-10)	Kingston Township STP	27.2	255.0	914	13.7	12.7	5 ports
12-03-008	Kingston City STP	49.2	91.4	1,589	13.9	12.1	15 ports
12-03-011 (12-03-011)	Brockville STP Emergency Bypass		213.4	762	9.1	8.4	No
12-03-012	Brockville STP	17.6	30.4	914	14.8	17.9	
12-03-042	Cornwall STP	53.0	607.0	1,060	9.9	9,4	9 ports
Bay of Quinte Basin							
17-03-002 (17-03-001)	Trenton STP	11.9	43.4	1,219	3.1	2.0	No
Georgian Bay Basin							
03-03-009	Collingwood STP	15.9	67	914	7.0	6.11	No
03-03-013	Owen Sound STP	18.1	252.3	1,067	5.5	4.6	No
03-03-006	Midland STP	8.6	69.9	1,372	7.5	6.5	
St. Clair River Basin							
15-03-009	Sarnia STP	44.6	91.4	1,216	13.0	11.5	No
Lower Niagara Basin							
11-03-001	Fort Erie STP	9.5	121.9	609			

APPENDIX 2 (CONTINUED)

SOUTHERN ONTARIO OUTFALLS (CONTINUED)

Location	Capacity	Receiver
Brantford STP	56.8 ML/d	Grand R.
Galt STP	8.5	Grand R.
Dunnville STP	7.7	Grand R.
Fergus STP	5.0	Grand R.
Guelph STP	27.0	Speed R.
Kitchener STP	123	Grand R.
Niagara Falls STP	58.2	Chippawawa Power Canal
Orangeville STP	6.8	Credit R.
Port Colborne STP	6.1	Welland Canal
Simcoe STP	15.4	Lynn R.
Waterloo STP	45.4	Grand R.
Welland STP	54.5	Welland R.
Southwestern Region		
Chatham STP	20.5	Thames R.
London STP	23.6 20.9 5.5 124.3 18.2	Thames R.
Port Elgin STP	6.5	Saugeen R.
St. Thomas STP	17.0	Kettle Creek
Stratford STP	27.3	Avon R.
Tillsonburg STP	8.2	Big Otter Creek
Wallaceburg STP	6.8	Sydenham R.
Central Region		
Barrie STP	27.3	Kempenfelt Bay

APPENDIX 2 (CONTINUED)

SOUTHERN ONTARIO OUTFALLS (CONTINUED)

Location	Capacity	Receiver
Coburg STP	16.0	Coburg Brook
Halton Hills STP	13.6	Silver Creek
Lindsay STP	11.4	Scugog R.
North Toronto STP	45.5	Don R.
Milton STP	12.9	Oakville Creek
Orillia STP	18.2	Lake Simcoe
Peterborough STP	54.5	Ottonabee C
Whitby STP	14.8	Pringle Creek
Southeastern Region		
Arnprior STP	6.8	Madawaska R.
Belleville STP	36.4	Bay of Quinte
Carleton Place STP	5.5	Mississippi R.
Hawkesbury STP	12.3	Ottawa R.
Napanee STP	9.0	Napanee R.
Nepean STP	36.4	Watts Creek
Ottawa STP	36.4	Ottawa R.
Renfrew STP	8.6	Bonnechere R.
Smith's Falls STP	11.4	Rideau R.
Pembroke STP	11.4	Ottawa R.
Northwestern Region		
North Bay STP	36.4	Lake Nipissing

POOR

QUALITY

ORIGINAL